

WHAT IS CLAIMED IS:

1. A method for manufacture of autograft, allograft and xenograft implants which comprises assembling such implants from smaller pieces of graft materials to form a larger graft implant product.
2. A kit comprising assemblable parts of autograft, allograft and xenograft implants for assembling such implants from smaller pieces of graft materials to form a larger graft implant product which may be formed in the course of a surgical procedure to precisely meet the needs of a given patient or procedure.
3. A method of strengthening or reinforcing autograft, allograft and xenograft implants which comprises assembling such implants from smaller pieces of graft materials to form a larger graft implant product.
4. The method of claim 3 wherein the reinforced product is cancellous bone into which is inserted reinforcing material.
5. The method according to claim 4 wherein said reinforcing material comprises cortical bone.
6. A graft implant comprising any one or combinations of allograft materials, autograft materials, xenograft materials, synthetic materials, metallic materials assembled into a an assembled implant which is assembled into a single graft by use of reinforcing material to hold the constituent pieces of graft materials together.
7. The graft implant according to claim 6 wherein said reinforcing material comprises cortical bone.

- 1 8. The graft implant according to claim 6 wherein the assembled implant is pre-
2 treated or treated after assembly to incorporate biologically active or inert
3 materials.
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1 9. An implant comprising segments of cortical bone, cancellous bone, cortical-
2 cancellous bone, or combinations thereof pinned to each other by means of
3 cortical bone pins, wherein, prior to assembly or after assembly, the graft
4 materials are soaked, infused, impregnated, coated or otherwise treated with bone
5 morphogenetic proteins (BMP's), antibiotics, growth factors, nucleic acids,
6 peptides, or combinations thereof.
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1 10. The implant according to claim 6 comprising an assembled cancellous block, or
2 dowel, harvested from the iliac crest or another suitable site to form a Cloward
3 Dowel, iliac crest wedge, or cancellous bone block, dowel, reinforced by insertion
4 therein of cortical bone pins.
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1 11. The implant according to claim 6 comprising a cortical bone implant reinforced
2 by insertion therein of at least one cortical bone pin.
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1 12. The implant according to claim 6 comprising an assembled implant comprising
2 different segments of cortical bone, cancellous bone or both.
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1 13. The implant according to claim 6 comprising an assembled implant comprising
2 different segments of cortical bone, cancellous bone, demineralized cortical or
3 cancellous bone, synthetic material, and combinations thereof.
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1 14. The implant according to claim 13 wherein insertion of reinforcing pins provides
2 an implant with multiple load-bearing pillars.
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- 1 15. The implant according to claim 14 wherein said pins protrude from the surface of
2 the implant to engage with inferior, superior or both surfaces of bone between
3 which the implant is inserted.
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- 1 16. The implant according to claim 15 which is a spinal implant.
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- 1 17. The implant according to claim 15 comprising a cancellous portion of bone
2 implant that has been compression molded, and then affixed to other portions of
3 cortical or cancellous bone machined according to different or similar principles.
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- 1 18. The implant according to claim 6 in the form of a tapered dowel
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- 1 19. A method of repairing a bone implant which comprises insertion therein of at
2 least one cortical bone pin.
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- 1 20. The method according to claim 19 which further comprises affixing a piece of
2 bone to an existing bone implant by affixing said piece of bone to said cortical
3 bone pin.
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- 1 21. The method according to claim 1 for making an instrument for insertion of other
2 implants.
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- 1 22. The method according to claim 21 which is an implant driver.
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- 1 23. A method for salvaging an implant that does not manufacturing specifications
2 which comprises insertion of at least one cortical bone pin at a site to reinforce
3 said site such that in combination with said at least one cortical bone pin, said
4 implant meets manufacturing specifications.
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- 1 24. An assembled implant comprising a first bone segment pinned to a second bone
2 segment with a flexible tissue affixed between said first bone segment and said
3 second bone segment.
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- 1 25. The assembled implant according to claim 24 wherein said first and second bone
2 segments are affixed to each other by means of at least one cortical bone pin.
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- 1 26. A composite bone graft, comprising: a plurality of bone portions layered to form a
2 graft unit, and one or more biocompatible connectors for holding together said
3 graft unit, said biocompatible connectors do not comprise an adhesive.
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- 1 27. A composite bone graft comprising:
2 two or more distinct bone portions, and one or more biocompatible connectors,
3 wherein said biocompatible connectors hold together said two or more bone
4 portions to form said composite bone graft, said biocompatible connectors do not
5 comprise an adhesive.
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- 1 28. A composite bone graft comprising two or more connected, distinct, bone
2 portions, said connected, distinct, bone portions do not comprise an adhesive.
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- 1 29. A composite bone graft comprising three or more connected, distinct, bone
2 portions, said connected, distinct, bone portions are not connected with an
3 adhesive.
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- 1 30. The composite bone graft of any one of claim 26, wherein said bone portions are
2 selected from the group consisting of: cortical bone and cancellous bone.
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- 1 31. A composite bone graft, comprising:
2 a first bone portion;
3 a second bone portion;
4 a third bone portion, said first, second and third bone portions are layered to form
5 a graft unit; and
6 one or more biocompatible connectors for holding together said graft unit, said
7 biocompatible connectors do not comprise an adhesive.
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- 1 32. A composite bone graft, comprising:
2 a first cortical bone portion;
3 a second cortical bone portion;

4 a cancellous bone portion disposed between said first cortical bone portion and
5 said second cortical bone portion to form a graft unit; and
6 one or more biocompatible connectors for holding together said graft unit, said
7 biocompatible connectors do not comprise an adhesive.

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1 33. A composite bone graft, comprising:
2 a first cortical bone portion;
3 a second cortical bone portion provided on said first cortical bone to form a graft
4 unit; and one or more biocompatible connectors, connecting said graft unit, said
5 biocompatible connectors do not comprise an adhesive.

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1 34. A composite bone graft, comprising:
2 a first bone portion;
3 a second bone portion provided on said first bone portion to form a graft unit; and
4 one or more biocompatible connectors for holding together said graft unit, said
5 biocompatible connectors do not comprise an adhesive.

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1 35. A composite bone graft, comprising: a plurality of cortical bone portions layered
2 to form a graft unit, and one or more biocompatible connectors for holding
3 together said graft unit, said biocompatible connectors do not comprise an
4 adhesive.

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1 36. A composite bone graft, comprising:
2 one or more cortical bone portions layered to form a first unit;
3 one or more cortical bone portions layered to form a second unit;
4 one or more cancellous bone portions layered to form a third unit; said
5 third unit disposed between said first unit and said second unit to form a graft
6 unit; and
7 one or more biocompatible connectors for holding together said graft unit, said
8 biocompatible connectors do not comprise an adhesive.

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1 37. A composite bone graft, comprising:
2 a graft unit having one or more through-holes configured to accommodate
3 one or more pins, said graft unit comprising:
4 two or more bone portions layered to form said graft unit, and
5 one or more pins connecting bone portions of said graft unit, said composite bone
6 graft does not comprise an adhesive.

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1 38. The composite bone graft of claim 37, said one or more pins comprising one or
2 more biocompatible materials selected from the group consisting of: cortical
3 bone; stainless steel; titanium; cobalt-chromium-molybdenum alloy; a plastic of
4 one or more members selected from the group consisting of: nylon,
5 polycarbonate, polypropylene, polyacetal, polyethylene, and polysulfone; and one
6 or more bioabsorbable polymers.

- 1 39. The composite bone graft of claim 38, said two or more bone portions
2 comprising:
3 a first bone portion comprising one or more cortical bone portions;
4 a second bone portion comprising one or more cortical bone portions; and
5 a third bone portion comprising one or more cancellous bone portions disposed
6 between said first bone portion and said second bone portion to form said graft
7 unit.
- 1 40. The composite bone graft of claim 38, said one or more pins comprise one or
2 more cortical bone pins.
- 1 41. A composite bone graft, comprising:
2 a graft unit having one or more through-holes configured to accommodate one or
3 more pins, said graft unit comprising:
4 a first plate-like cortical bone portion;
5 a second plate-like cortical bone portion;
6 a plate-like cancellous bone portion disposed between said first plate-like cortical
7 bone portion and said second plate-like cortical bone portion to form said graft
8 unit, and
9 one or more cortical bone pins connecting bone portions of said graft
10 unit, said composite bone graft does not comprise an adhesive.
- 1 42. A composite bone graft, comprising:
2 a graft unit having one or more through-holes configured to accommodate
3 one or more pins, said graft unit comprising:
4 a first plate-like bone portion;
5 a second plate-like bone portion provided on said first plate-like bone to
6 form said graft unit, and
7 one or more bone pins for holding together said graft unit, said composite bone
8 graft does not comprise an adhesive.
- 1 43. A method for restoring vertical support of the posterior column, comprising
2 implanting a composite bone graft comprising two or more distinct bone portions
3 held together by one or more biocompatible connectors, at a site in a patient.
- 1 44. A composite bone graft, comprising:
2 a graft unit having one or more through-holes configured to accommodate one or
3 more pins, said graft unit comprising:
4 two or more bone portions layered to form said graft unit,
5 one or more pins connecting said bone portions of said graft unit, and
6 a centrally located through-hole disposed perpendicular to interfaces of layered
7 bone portions of said graft unit, said composite bone graft does not comprise an
8 adhesive.
- 1 45. A method for making a composite bone graft for implantation into a patient,
2 comprising:

3 stacking two or more parallel bone planks to form a graft unit;
4 providing one or more through-holes in said graft unit perpendicular to I
5 interfaces of bone planks;
6 connecting said two or more parallel bone planks of said graft unit with
7 one or more pins disposed in said one or more through-holes to form a pinned
8 graft unit; and
9 shaping said pinned graft unit to form said composite bone graft.

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1 46. A composite bone graft, comprising:
2 one or more cortical bone portions layered to form a first unit;
3 one or more cortical bone portions layered to form a second unit;
4 one or more demineralized cancellous bone portions layered to form a
5 third unit; said third unit disposed between said first unit and said second unit to
6 form a graft unit; and
7 one or more biocompatible connectors for holding together said graft unit, said
8 biocompatible connectors do not comprise an adhesive.

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1 47. A composite bone graft, comprising:
2 one or more cortical bone portions layered to form a first unit;
3 one or more cortical bone portions layered to form a second unit;
4 one or more demineralized cortical bone portions layered to form a third
5 unit; said third unit disposed between said first unit and said second unit to form a
6 graft unit; and
7 one or more biocompatible connectors for holding together said graft unit,
8 said biocompatible connectors do not comprise an adhesive.

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1 49. A composite bone graft, comprising:
2 a first unit comprising one or more bone portions;
3 a second unit connected to said first unit, comprising one or more bone
4 portions; and
5 one or more biocompatible connectors for connecting said first unit and said
6 second unit, wherein said first unit and said second unit are not in physical contact
7 and define a void therebetween, said biocompatible connectors do not comprise
8 an adhesive.

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1 50. A composite bone graft, comprising: two or more distinct interlocking cortical
2 bone portions.

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1 51. A composite bone graft, comprising: two or more distinct adjacent bone portions
2 where adjacent bone portions are configured to interlock with each other.

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1 52. A composite bone graft, comprising: two or more distinct adjacent bone portions
2 where adjacent bone portions are configured to interlock with each other, and one
3 or more locking pins partially or entirely traversing a dimension of said composite
4 bone graft.

- 1 53. A composite bone graft, comprising: two or more distinct adjacent bone portions
2 where adjacent bone portions are configured to interlock with each other to form
3 an interlocked graft unit, said interlocked graft unit is self-locking.
- 1 54. A composite bone graft, comprising: two or more distinct adjacent bone portions,
2 said distinct adjacent bone portions comprising complementary peg-like
3 protrusions and corresponding depressions, said protrusions and depressions
4 interlock to provide an interlocking fit between said adjacent bone portions.
- 1 55. A composite bone graft, consisting essentially of: two or more distinct adjacent
2 bone portions where adjacent bone portions are configured to interlock with each
3 other.
- 1 56. A composite bone graft, consisting essentially of: two or more distinct adjacent
2 bone portions, said distinct adjacent bone portions comprising complementary
3 peg-like protrusions and corresponding depressions, said protrusions and
4 depressions interlock to provide an interlocking fit between said adjacent bone
5 portions.
- 1 57. A composite bone graft, consisting essentially of: two or more distinct adjacent
2 bone portions, said distinct adjacent bone portions comprising complementary
3 peg-like protrusions and corresponding depressions, said protrusions and
4 depressions interlock to provide an interlocking fit between said adjacent bone
5 portions; and one or more locking pins partially or entirely traversing a
6 dimension of said composite bone graft.
- 1 58. A composite bone graft, consisting essentially of: two or more distinct adjacent
2 bone portions where adjacent bone portions are configured to interlock with each
3 other, and one or more locking pins partially or entirely traversing a dimension of
4 said composite bone graft.
- 1 59. A composite bone graft, comprising: two or more distinct adjacent bone portions
2 where adjacent bone portions are configured to interlock with each other to form
3 an interlocked graft unit, and one or more locking pins traversing a dimension of
4 said composite bone graft, to lock said interlocked graft unit.
- 1 60. A composite bone graft, comprising: two or more distinct interlocking bone
2 portions, said interlocking bone portions are self-locking.
- 1 61. A composite bone graft, comprising: two or more distinct interlocking bone
2 portions, and one or more locking pins to lock said interlocking bone portions.
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